Viavi T-BERD 5800
CPRI Testing Guide with ALU BBU Emulation


Version 4
January 2018

Firmware 26.0.0.6c1973b or Later REQUIRED!

Scope

This document describes Common Public Radio Interface (CPRI) testing procedures. This document is intended to be a method of procedure (MOP) for configuring CPRI test setups, running tests, analyzing results, and creating reports with the Viavi T-BERD 5800v2. This document is not intended to be a user guide. This MOP should be used in conjunction with T-BERD User's Guides for detailed explanation of all testing options.

This document describes three test applications for the CPRI Check test: Verifying provisioning and operation of CPRI Radio Equipment such as a Remote Radio Unit (RRU) unit
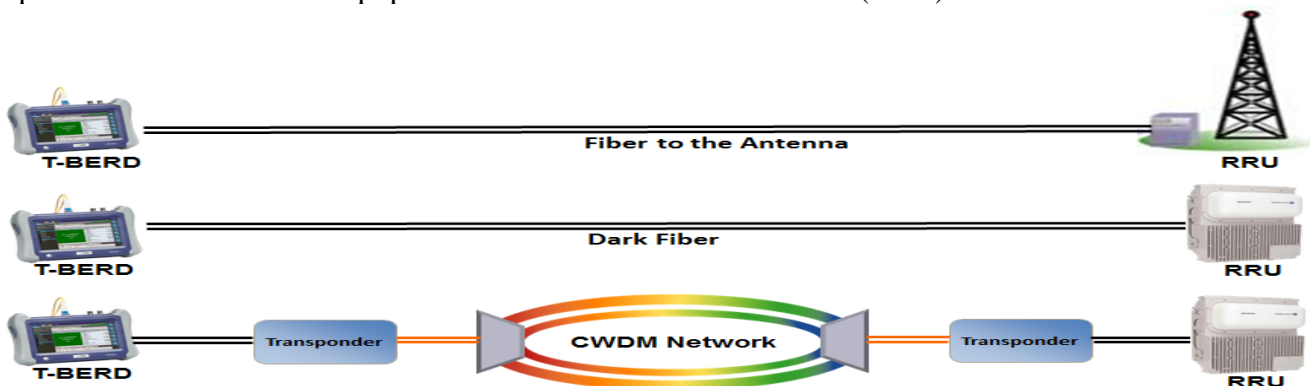
1. Optical Time Domain Reflectometry (OTDR)

An OTDR sends thousands of very short pulses of light at designated wavelengths into the fiber under test. It detects the amplitude and time delay of both the scattering and the reflection of the light as it returns to the same interface. Through computations, an OTDR builds a picture of the loss characteristics of the fiber throughout its path. It then asserts the location and nature of events such as splices, bends, breaks, connectors and the fiber end. It also provides the aggregate loss of the fiber from start to end.
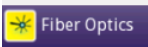
An Insertion Loss test can tell you if a fiber run is performing acceptably. If it fails your threshold, you do not know where the problem or problems are. An OTDR will tell you each and every contributor to the losses incurred in the fiber system. Thresholds can be set not just for total loss (dB) but for each contributing element.

Follow this procedure to set up a T-BERD 5800 to run the Optical Time Domain Reflectometer (OTDR). The picture below is of a TBERD 5800v2 with a Single Mode OTDR module attached. The post of the OTDR module is covered with a green dust protector indicating that an Angled Physical Contact (APC) connector is used on the port.
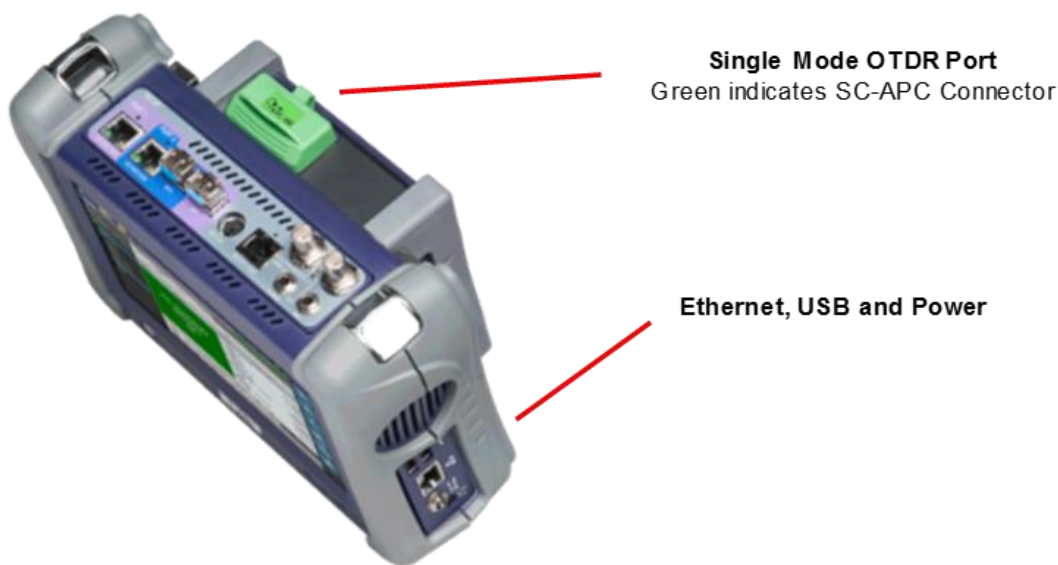
USEFUL INFORMATION: It is important to know the fiber distance from the BBU connection to the RRU connection. This is typically the length of the hybrid plus any jumpers. These parts are typically purchased at some standard length. When you run the OTDR test, you want to see the Test Set declare "End of Fiber" at a distance that correlates to the "as built" information for the system under test. A declaration of "End of Fiber" before that length indicates a connection is still open or there is a fiber break.

1.1   Test Setup

| Step	Action	Details
1.	Power On	Press and hold the ON/OFF button to turn on the T-BERD 5800v2.
2.	Select Test	Select the Fiber Optics Tab at the top of the screen

From the Home Screen ![home icon], select FTTA OTDR ![FTTA OTDR icon] (turns Yellow)

Select the test tab ![keyboard icon] and then the Setup button ![Setup icon], then Load Config ![Load Config icon] in the lower right corner.

Select **FTTA_RRU_ConstrLoop.SM-OTDR** and **Load as FTTA Config**
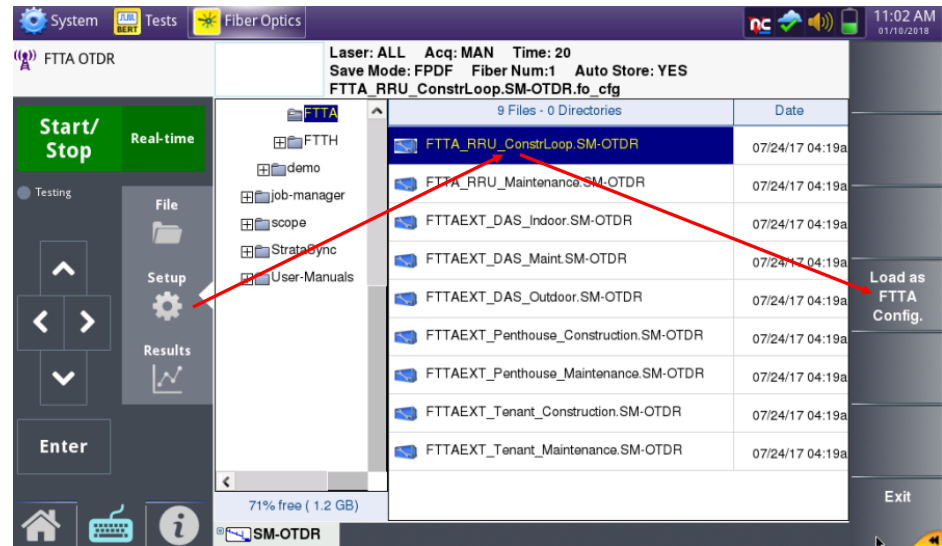

3. Clean & Inspect	(IBYC) Ensure all test jumpers, the hybrid cable and the OTDR port are clean using a Fiber Inspection probe and cleaning supplies. The technician at the tower top should do the same with all connections including the loopback cable.
4. Ensure continuity	The VFL Continuity test should have been completed earlier and the 10-meter loopback fiber left in place at the tower top.
5. Connect	Connect the 10 meter SC-APC to LC-PC launch cable from the TB5800 OTDR port to the fiber pair under test using a duplex LC coupler. Also connect a 10-meter "receive cable" to the other port on the duplex coupler. This receive or run out cable will give the OTDR visibility to the last connection that will part of the system. Optionally, place a non-reflective terminator at the end of the receive cable. If you do not have such, just make sure that the end of the fiber will be pointed safely away so that there is no chance that the laser light could reach anyone's eyes either directly or by reflecting off a surface.
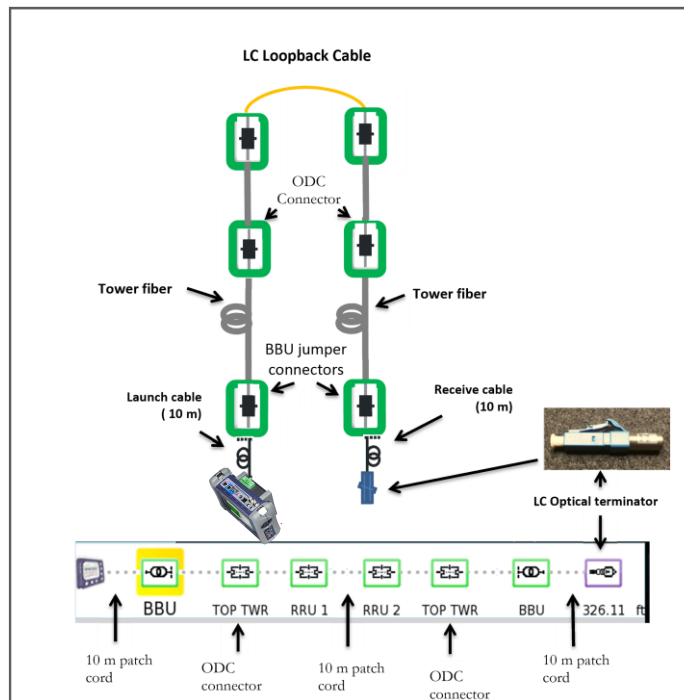
The schematic on the left shows the path up and down the tower independently, but the up/down paths are really the 2 fibers in a fiber pair with the connectors aligned side by side.
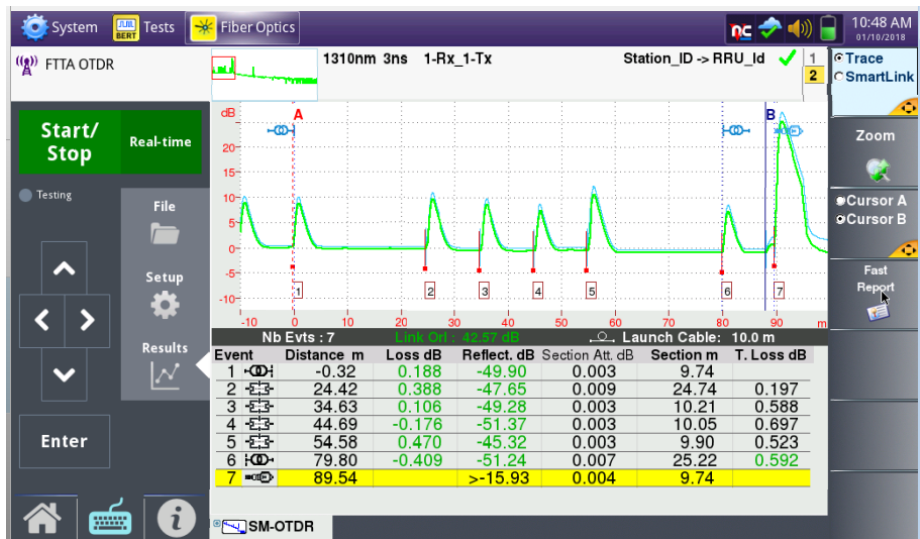
6. Run the Test
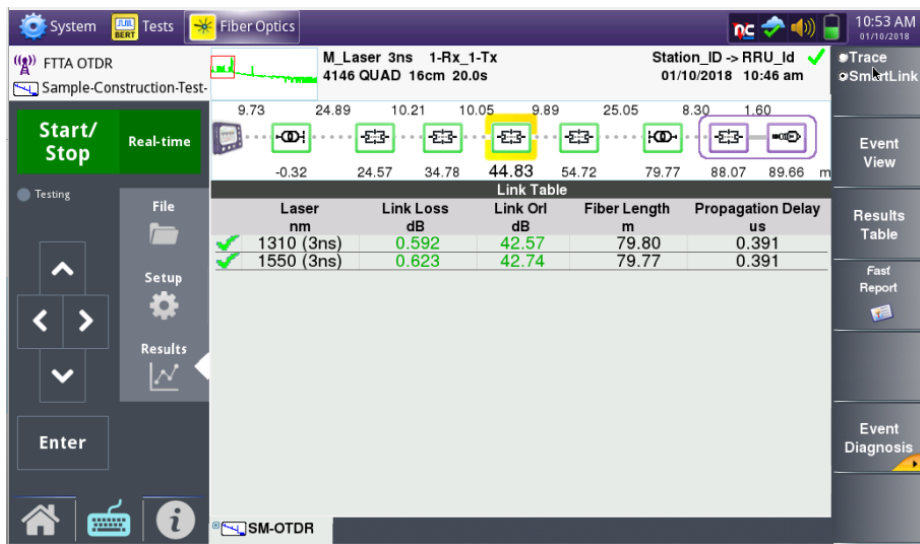
Touch the **Start/Stop** green button

The OTDR will take about 45 seconds to run a test at 1310 nm and another at 1550 nm.

7. Interpretation

Much like a sweep test on coaxial cable, the OTDR is looking for reflective events along the path. It also detects Raleigh scattering along the entire fiber which allows it to detect non-reflective events as well. It presents the results in a graph and in a graphical form. Each connector as well as the end of the fiber will be detected. Bends or kinks in the fiber will show up as well. A broken or cut will be declared as "End of Fiber". Any events that exceed the thresholds should be investigated. An "End of Fiber" that is clearly short of the "as built" records for this site is actually a broken fiber that needs to be swapped or replaced. Below is an example of a traditional Trace View. Each event is a peak on the graph. Events that surpass a threshold will have RED values in the table below.

Nb Evts : 7 Link Ori : 42.57 dB Launch Cable: 10.0 m

Event	Distance m	Loss dB	Reflect. dB	Section Att. dB	Section m	T. Loss dB
1	-0.32	0.188	-49.90	0.003	9.74	
2	24.42	0.388	-47.65	0.009	24.74	0.197
3	34.63	0.106	-49.28	0.003	10.21	0.588
4	44.69	-0.176	-51.37	0.003	10.05	0.697
5	54.58	0.470	-45.32	0.003	9.90	0.523
6	79.80	-0.409	-51.24	0.007	25.22	0.592
7	89.54		>-15.93	0.004	9.74	

The screen shot below is the same test result, but presented in a graphical form instead of the traditional "trace" view.

Link Table

Laser nm	Link Loss dB	Link Orl dB	Fiber Length m	Propagation Delay us
1310 (3ns)	0.592	42.57	79.80	0.391
1550 (3ns)	0.623	42.74	79.77	0.391

Values in black are unjudged results

Values in Green have been assessed against a threshold and they Pass

Values in Red (none shown) have been assessed against a threshold and they failed. Investigate any values in red. If it is a connector, re-inspect and clean if necessary and re-run the test.

Note the symmetry in the Trace View. There is 10 meters of launch and receive cable at the 2 ends. The Hybrid cable was 25 Meters long. The jumper from the end of the Hybrid to the RRU was 10 meters. The loopback cable that loops the end of the RRU jumper is also 10 meters. Every successful test should look similar to this one. The main differences might be that the Hybrid and/or RRU jumper is different from the previous.

2. Verifying provisioning of an RRU with RF over CPRI Spectrum Analysis

Follow this procedure to set up a T-BERD and test a CPRI link and RRU, and perform RF over CPRI Spectrum Analysis for PIM detection and Diversity Imbalance. The test may be run on dark fiber or through Layer 1 network elements such as transponders and multiplexors. The CPRI Radio Equipment should be installed at the far end on the link before testing.

Note: This is a dual port application. Port 1 is used by default

Step	Action	Details
1.	Power On	Press the ON/OFF button to turn on the T-BERD.
2.	Insert SFP	Insert an SFP or SFP+ that supports the Wavelength, CPRI rate and range of the line under test into the T-BERD 5800v2's Port 1 SFP+ slot. **Note: All SFPs do not support CPRI. Use a Viavi approved CPRI SFP (see Appendix A) or one approved by your CPRI network equipment manufacturer.**
3.	Clean & Inspect	Ensure that fiber and connectors are clean using a Fiber Inspection probe.
4.	Connect	Connect the SFP or SFP+ to the CPRI port under test using yellow Single Mode Fiber jumper cables (LC-LC). You may need to attenuate the signals if you are using a long range SFP/SFP+.
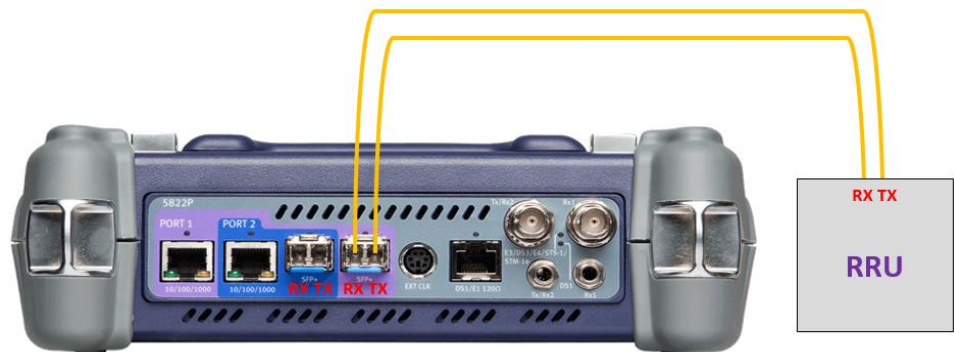
5. Test Menu   Press the [Tests] button to access the BBU Test

6. Launch Test   Select the CPRI Check ALU BBU Emulation test for the proper rate
                      (usually 4915.2M)

2457.6M CPRI Check ALU BBU Emulation

4915.2M CPRI Check ALU BBU Emulation

9830.4M CPRI Check ALU BBU Emulation
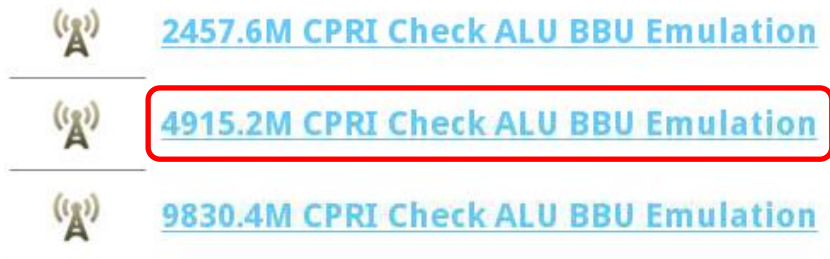
7. Manual Launch   If the above tests are not loaded on the 5800 follow the next steps to
                      launch the CPRI Check for ALU BBU Emulation.
                      From the [Select Test] menu, select CPRI>>RATE>>CPRI
                      Check>>P1 Terminate

CPRI	▶	614.4M	▶		
OBSAI	▶	1228.8M	▶		
OTN	▶	2457.6M	▶		
Optical BERT	▶	3072.0M	▶		
Timing	▶	4915.2M	▶	CPRI Check ▶	P1 Terminate
		6144.0M	▶	Layer 2 BERT ▶	P2 Terminate
Load Test...		9830.4M	▶		
Save Test As...		10137.6M	▶		
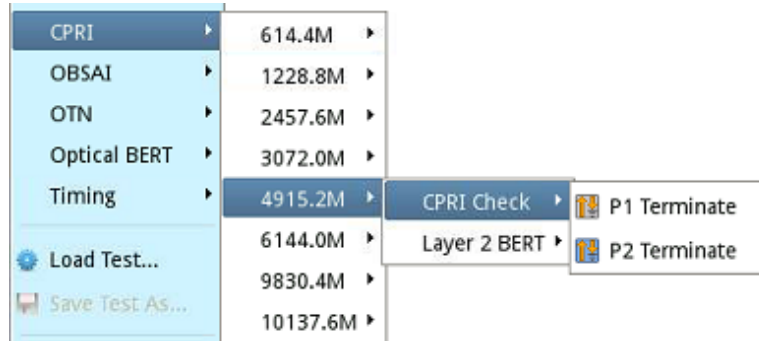
8. NOTE: The test will launch on **PORT 1** <u>**UNLESS**</u> there is already a test running
                      Verify the port in the upper right-hand corner of the screen
                      If needed move the SFP to port 2 as shown on the previous page

Port 1: 4915.2M CPRI Layer 2 BERT Term

Go To...

4. Creating a New RRH Configuration

Step	*Action*	*Details*
1.	Select Tests	Press the [Go] button to Start a new Configuration

Select ALU for the "Far-end Device" (default) and check to test needed for BBU Emulation

Press the [Next CPRI Link] button to advance to the Link page

| 2. | Link values | Set the test duration and SFP power if desired |
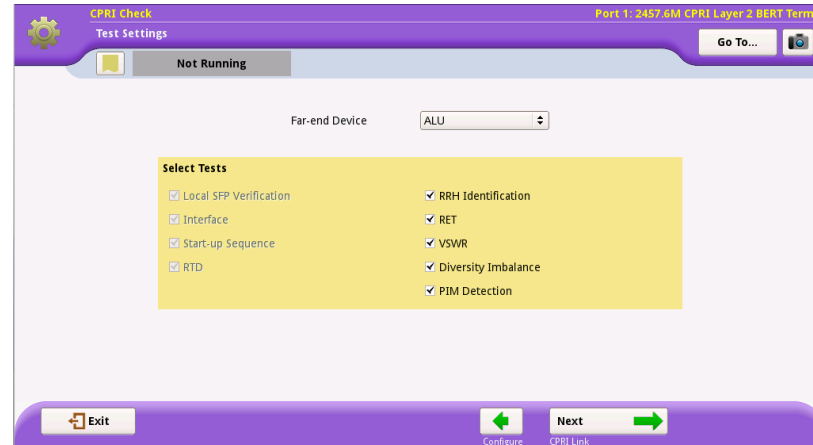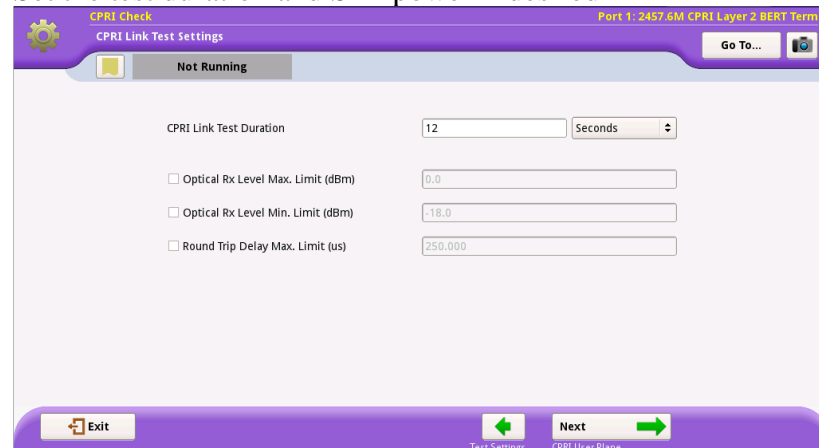
Press the [Next CPRI User Plane] button to advance to the RRH page

| 3. | RRH Settings | Click the RRH Bandwidth drop down box [RRH Settings Bandwidth 10 MHz] and select the Bandwidth needed |

4. Antenna Test   Select the Transmit Antenna to test

Transmit on

Tx1

5. Waveform   Set the Waveform to LTE-FDD TM3.1 (NOTE TM3.1 is required for
FULL OCNS channels to test VSWR and PIM)

Waveform

LTE-FDD TM3.1
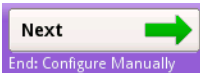
6. Return   Press the [Next / Save Profiles] button to proceed to the Save Profile screen

7. Save Profile   ==To save the configuration in the Save Profiles screen, enter a Filename, and tap [Save Profiles], tap [OK], and tap [Next] twice.==
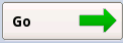
8. Continue   After saving the profile Press the press the [Next / End: Configure Manually] arrow to advance to the test screen

GOTO Section 2 BBU Emulation

Loading a saved Configuration
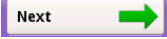
1. Run Wizard   Load a save configuration by pressing the [Go] button under the "Load Configuration from a Profile" area

Load Configuration from a Profile   Go

NOTE: If a configuration for the RRH does NOT exist, proceed **Section 4 Creating a New RRH Configuration**

Select the configuration and press the [Load Profiles] button

Press the [OK] button to accept the configuration

Press the [Next] button to advance to the next screen

GOTO Section 2 BBU Emulation (Next page)

2. BBU Emulation

Running the Test

Step	Action	Details

1. Launch

Press the [Go →] button to start the test

2. SFP Verification

In the **Local SFP Verification** screen, verify that the SFP meets the requirements of the line under test.

If the SFP was purchased from or approved by Viavi, and supports the selected CPRI line rate, the following screen will be displayed:
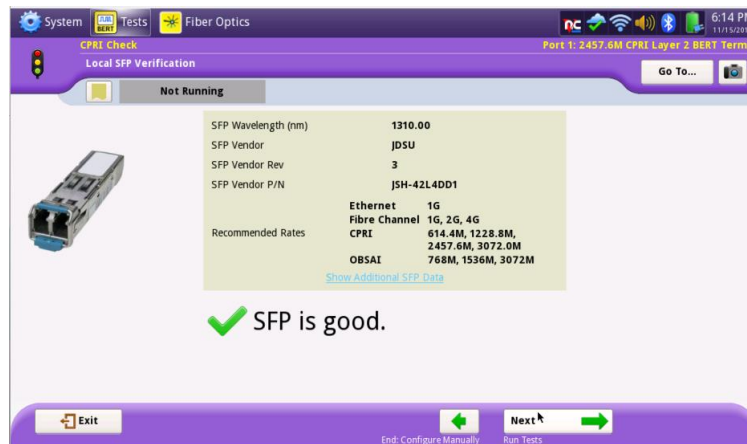
Tap [Next →] to proceed to step 5.

If the SFP was sourced from your CPRI Network Equipment Manufactured and has not been tested and approved by Viavi, the following screen will be displayed:
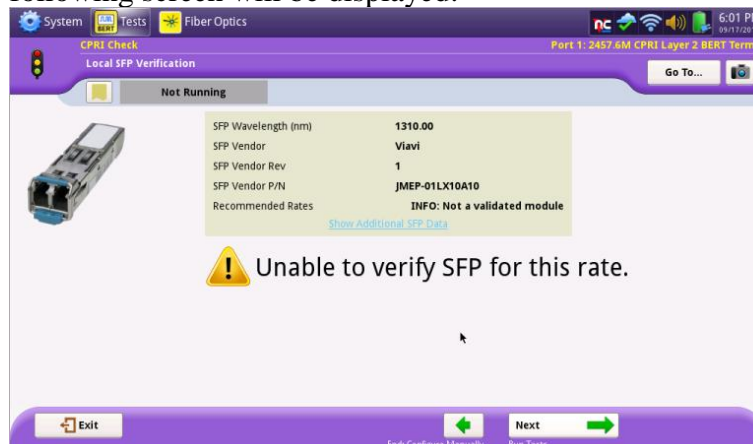
Check that the SFP Wavelength, SFP Vendor, and SFP Part Number are approved for this CPRI line rate. Tap [Next →] to proceed.

3. Run Tests

Tap [Run Test]. The T-BERD will run all configured tests.
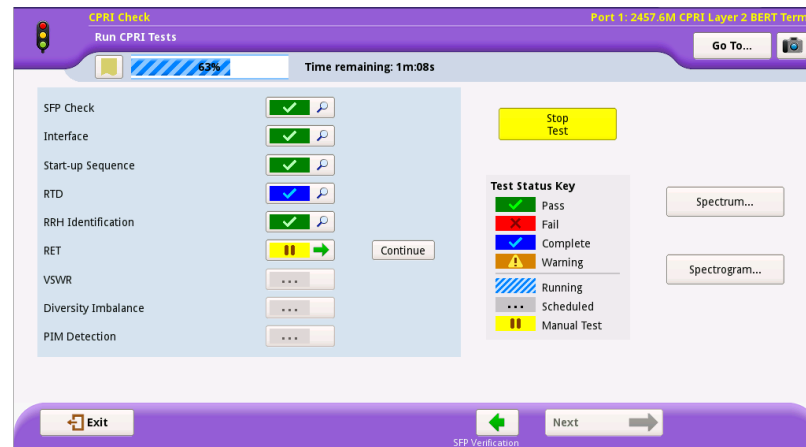
The first 5 tests (SFP Check, Interface, Start-up Sequence, RTD) will run simultaneously for the time specified in the setup screen (usually 30 seconds). Once completed, the RRH Identification test will run.

4. View Details

Press the [✓ 🔍] button for RRH Identification to view the details about the connected RRH
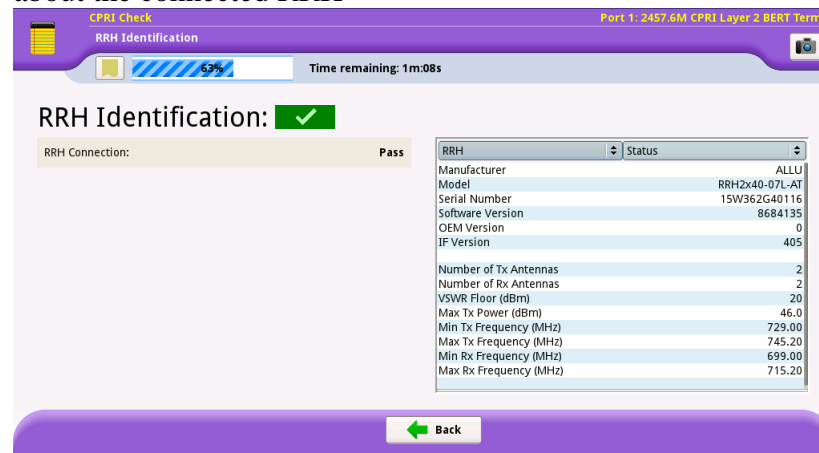
5. Return

Press the [← Back] button to return to the test screen

6. RF Tests

RET, VSWR, Diversity Imbalance, and PIM testing require specific information for the RRU under test.
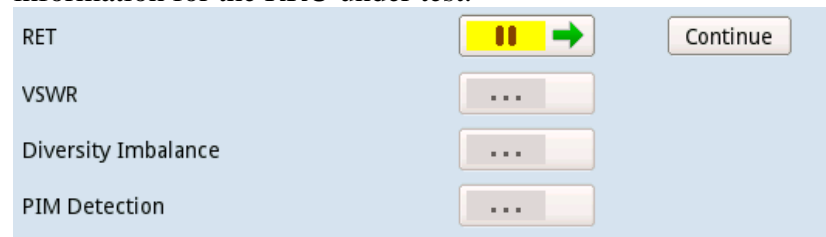
7. RET   Press the [▶] button to enter the RET Test
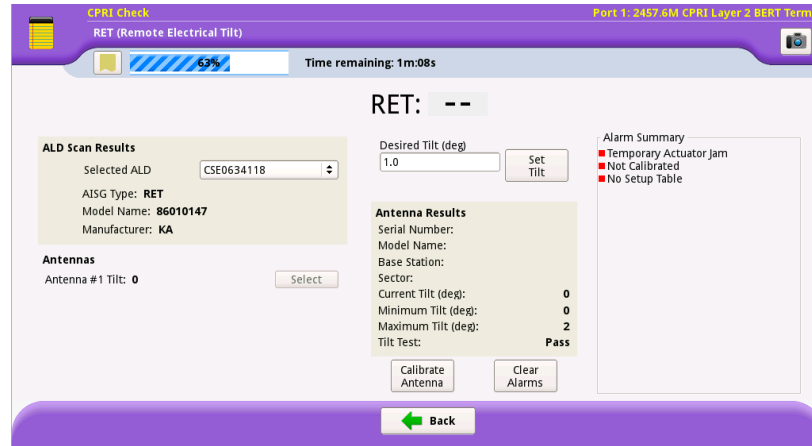
8. RET Info   Select the ALD (RET Controller) from the list and check the Alarm state

9. Return   Press the [← Back] button to return to the test screen

10. Continue   Pres the [Continue] button to continue to the next test.

11. VSWR   Press the [▶] button to enter the VSWR Test
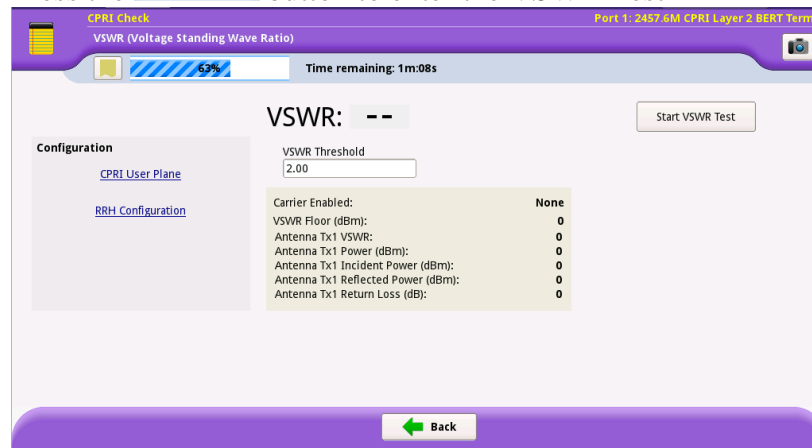
12. RRH Configuration The VSWR test requires the RRH to be configured with specific data to transmit at full power. **The data entered will be the same for Band 13 (700MHz) but will vary for AWS and PCS RRHs**. The data below is for Band 13(700MHz) RRHs

13. Configure   **Select** the [RRH Configuration] link and enter the following information:

Bandwidth	Bandwidth of LTE signal	10 MHz
Tx Frequency	Downlink Frequency	751MHz
Rx Frequency	Uplink Frequency	782MHz
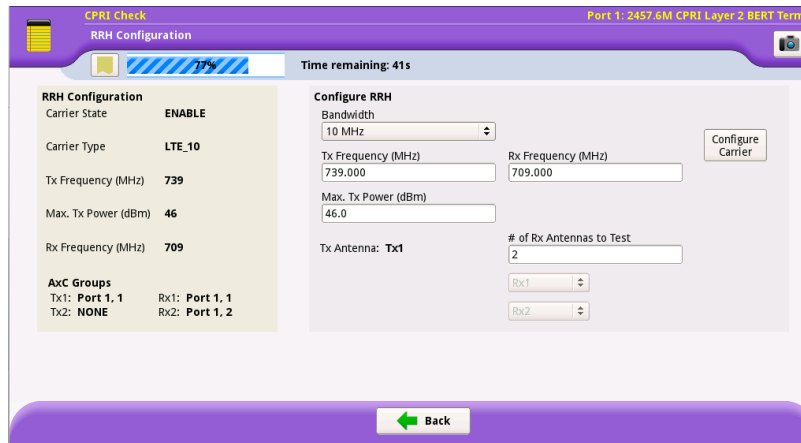
14. Enable

Press the **Configure Carrier** button to Set the RRH. Once completed the Carrier State will show ENABLE **Carrier State ENABLE**

   a. NOTE – If the data was entered incorrectly the Tx and Rx frequencies will how "0" and are invalid and the Carrier State will be DISABLED
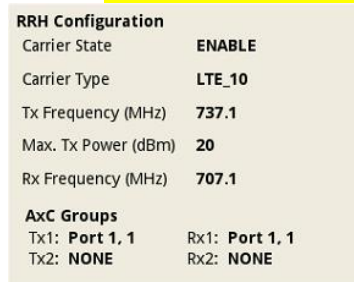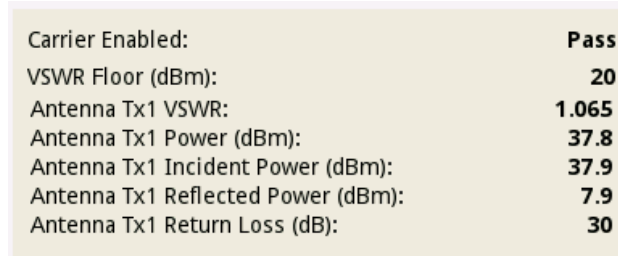

15. Return

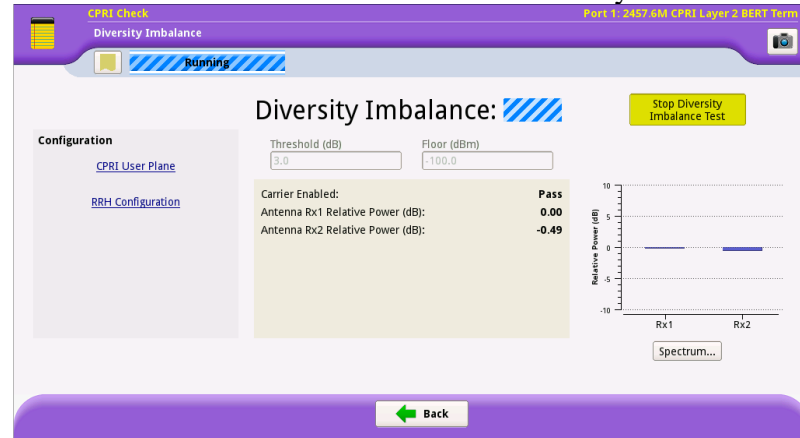Press the **← Back** button to return to the VSWR screen

16. Run VSWR

Press the **Start VSWR Test** button to run the VSWR test

17. Return

Press the **← Back** button to return to the test screen

18. Continue

Press the **Continue** button to continue to the next test.

19. Diversity	Press the [⏸️ ➡️] button to enter the Diversity Imbalance Test

The Diversity Imbalabnce test requires the RRH to be configured with specific data to transmit at full power. Please refer to step 13 if the VSWR test was not run
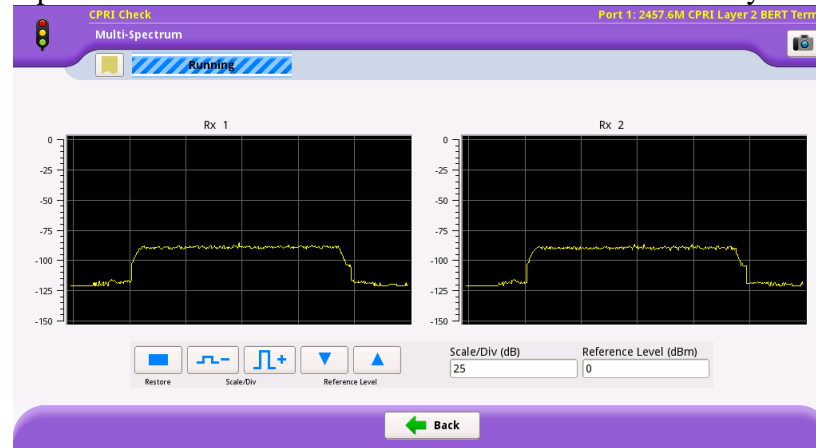
20. Diversity	Press the [Stop Diversity Imbalance Test] button to RUN the Diversity Test
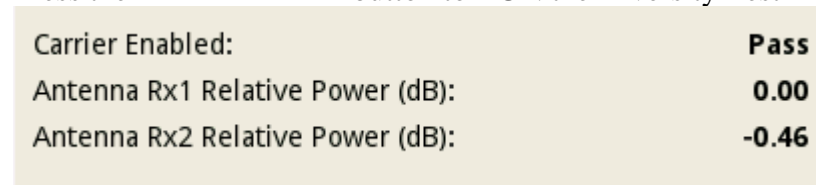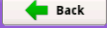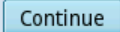
21. Spectrum	Optional - Press the [Spectrum...] button to view the Diversity Screen

22. Return	Press the [⬅️ Back] button to return to the Diversity Imbalance test screen
23. Continue	Press the [Continue] button to continue to the next test.
24. PIM	Press the [⏸️ ➡️] button to enter the PIM Test
	The PIM test requires the RRH to be configured with specific data to transmit at full power. Please refer to step 13 if the VSWR test was not run

25. PIM   Press the [Start PIM Test] button to RUN the PIM Test

Level Diff. (dB):	-0.58
Average Level (dBm):	-122.99
Carrier Enabled:	Pass
Signal Detection:	None

26. Spectrum   Optional - Press the [Spectrum...] button to view the PIM trace

27. Return   Press the [Back] button to return to the PIM test screen

28. Return   Press the [Back] button again to return to the test screen

29. Continue   Pres the [Continue] button to Complete the tests.

                              At the conclusion of the test, Pass/Fail status for each test will be indicated by green checkmark, [✓], or red x, [✗]. Test for which no pass/fail threshold was specified will have a blue checkmark, [✓]. Detailed results for each test can be viewed by tapping [🔍].
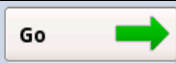
30. Results   Press the [Next →] button to create a report or to Exit the CPRI Check

3. Creating a Report

Step	Action	Details

1. Report — Press the [Go] button to Create a report

Create Report [Go]

2. Information — Enter the Job information

Test Report Information

Customer Name:	ACME
Technician ID:	55231
Test Location:	Spokane
Work Order:	123
Comments/Notes:	--
Radio:	700MHZ RRH
Band:	Band 14

31. Format — Press the [Next] button to proceed to the next screen

32. Save — Name the File and press the [Create Report] button to Create a report

Format

○ PDF   ○ CSV   ○ Text   ○ HTML   ○ XML

File Name

CPRI_Check-2017-11-04T10.35.05   [Select...]
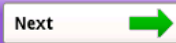
[Screenshot Files]   ☑ View report after creation   ☑ Include screenshots   [Create Report]   [View Report]

CPRI Check Overall Test Result: Fail

SFP Check	✔
Interface	✔
Start-up Sequence	✔
RTD	✔
RRH Identification	✔
RET	✘
VSWR	✔
Diversity Imbalance	✔
PIM Detection	✔

33. Repeat — Press the [Next] button to proceed to the Test section. All test can be repeated on other RRHs without the need for Setup.

END OF TESTING